Assignment 03

Due date: 07 April 2017

Unique assignment number: 790666

Semester period: 01

INSTRUCTIONS

1) Answer this assignment only if you are registered for Semester 1.

2) Read section eight of this tutorial letter before starting this assignment.

3) Carefully study **ALL** the Study Units in your Study Guide to complete Assignment 03.

4) Remember to refer to the prescribed textbook as referred to in the Study Guide.

5) Answer all questions as clearly as possible.

6) Except for definitions, formulate answers in your own words.

7) Now answer the questions that follow.
Question 1

1.1 Classify the following substances as an element, a compound, a homogenous mixture or heterogeneous mixture: (5)

1.1.1 Stew - Heterogeneous mixture [1]
1.1.2 Aluminium - Element [1]
1.1.3 Water - Compound [1]
1.1.4 Milk - Homogenous mixture [1]
1.1.5 Salt - Compound [1]

1.2 List six important points regarding the structure of an atom. (6)

An atom can be pictured as a sphere with a central nucleus and electrons rotating around the nucleus [1].

The nucleus (the collective noun for which is nucleons) contains two types of particles, namely protons and neutrons [1].

Protons and neutrons (in the nucleons) have approximately equal masses [1].

A proton carries one positive charge; a neutron has no charge [1].

The volume of the nucleus is very small compared to that of the entire atom [1].

The mass of the atom is concentrated in the nucleus.

Electrons are located outside the nucleus [1].

Each electron carries one negative charge [1].

An electron weighs only about 1/1350 as much as a proton or neutron [1]

1.3 Draw the following table in your answer sheet and fill in the blank spaces (one column per element) (14)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of protons</td>
<td>18</td>
<td>5 [1]</td>
<td>14</td>
<td>17  [1]</td>
</tr>
</tbody>
</table>

1.4 What is the number of valence electrons for Sulphur? (1)

In group VI, therefore, Sulphur has 6 valence electrons [1]

1.5 Explain why soaped white sheets bleached when they are spread out on grass on a sunny day (2)

Because the oxygen in the air [1] and the oxygen produced by the green grass during photosynthesis oxidised stains [1]. The alkali from the soap speeds up the bleaching process.
1.6 Study the chemical formula below and then answer the questions that follow: 
3Na₂CO₃ (Sodium carbonate)

1.6.1 How many molecules of sodium carbonate are there in the above formula? 
3 [1]

1.6.2 What is the total number of atoms of each of the elements in the above formula of sodium carbonate? 

Sodium: 6 [1]  
Carbon: 3 [1]  
Oxygen: 9 [1]

1.7 Discuss the uses of salts in humans, laundering and cookery.  

**Human**
Iodine salts are necessary for the proper functioning of the thyroid gland [1]; calcium and phosphorus salts are necessary for the formation of bones and teeth [1]. Regulate the acid-base balance of the body, irritability of nerve and muscle cells and the beating of the heart [1], maintain the proper osmotic pressure of cells [1].

**Laundering**
Table salt is frequently used to remove stains [1] and also helps to preserve the colour of the fabric [1].

**Cookery**
Table salt is used to flavor food [1], preservative [1], making chutneys [1], biltong and used for corned beef [1].

1.8 Your aunt is very pleased with the copper cooking utensils she got as a birthday present from a friend. Your fellow student warns your aunt to rather use the utensils as ornaments and not for cooking, especially when vinegar is involved with cooking. Explain why your friend gives this advice to your aunt?  

Acids react with certain metals. The green deposit on copper (copper carbonate) will react with an acid to form a poisonous copper salt [1]. Vinegar contains acetic acid, which will react with the copper carbonate to form copper acetate, a highly poisonous salt [1].

**Question 2**

2.1 Express the following numbers in scientific notation:

2.1.1 0.215 - 2.15 x 10⁻¹  
2.1.2 23 358 - 2.3358 x 10⁴  
2.1.3 0.0045 - 4.5 x 10⁻³  
2.1.4 211 – 2.11 x 10²  
2.1.5 18.72 - 1.872 x 10¹
2.2 You want to know how many litres of water a specific container can take. The measurements of the container are as follows: breadth = 30cm, length = 55cm and height = 75cm. Calculate the volume of the container to determine how many litres of water the container can take. (4)

\[ V = L \times B \times H \] [1]
\[ = 55 \times 30 \times 75 \]
\[ = 123750 \text{ cm}^3 \]
\[ = 123750 \text{ ml} \] [1]
\[ 123750 \text{ ml} = 123.75 \text{ L} \] [1]

2.3 Explain the term capillarity and give three examples of the application of capillary force. (4)

Capillary is known as the rise of water or liquid in very small spaces [1]. When a very narrow tube is dipped into water, the water will rise up inside the tube above the external surface of the water (this can be taken as one of the examples student had to provide). This is due to the fact that the adhesion force between the glass and the water molecules is greater than the cohesion force between the water molecules [1].

Examples:
- Blotting paper and paper towels work because of capillarity. Water rises in the narrow spaces between the fibres [1]
- Kerosene moves up the wick of a kerosene lamp [1]
- A capillary tube is used to draw a small amount of blood after pricking the tip of your finger [1]

2.4 Two equal amounts of solution, A and B, are separated by a selectively permeable barrier. Over a period of time, the level on side A increases. Which solution initially had the higher concentration of solute? Describe the process that occurs while the level of side A is increasing (4)

Solution A must have initially had more solute than solution B [1]. As a result, water moved by osmosis [1] across the semi-permeable membrane from side B to side A (against concentration gradient) [1], increasing the fluid level on side A [1].

2.5 Consider the factors conduction, convection and radiation and motivate why a thermos flask is an efficient way of keeping coffee warm. (3)

Heat loss is prevented due to:
- Lack of conduction
  The glass walls of the thermos flask, the plastic or cork stopper and the vacuum between the double glass walls are very poor conductors of heat [1].
- Lack of convection
  Since no gas or liquid can leave a sealed thermos flask, heat cannot spread by convection [1].
- Lack of radiation
  The double glass walls of the flask are silver on the inside. Since the shiny surface reflects heat back into the flask, very little heat is lost [1].

Question 3
3.1 What are the four general functions of the cell membrane? (4)

Structural support [1]  
Physical isolation [1]  
Regulates the exchanges with the environment [1]  
Sensitivity [1]  

Students write this, which is also correct:

The cytoplasm membrane works as a boundary between the cell's internal fluid and its surrounding extracellular fluid between cells [1]. The cytoplasmic membrane helps with communication the plasma membrane is able to identify a cell as coming from one particular individual [1]. The cytoplasmic membrane determines the movement of substances in and out of the cell and carefully selects the movement of a substance in accordance to specific functions and needs of each individual cell [1].

3.2 Draw the following table in your answer sheet and tabulate the differences and similarities between facilitated diffusion and active transport. (7)

<table>
<thead>
<tr>
<th>Facilitated diffusion</th>
<th>Active transport</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Similarities:</strong></td>
<td></td>
</tr>
<tr>
<td>Both these processes make use of protein carriers [1]</td>
<td></td>
</tr>
<tr>
<td><strong>Differences:</strong></td>
<td></td>
</tr>
<tr>
<td>Concentration gradient (from high to low) [1]</td>
<td>No concentration gradient (from low to high) [1]</td>
</tr>
<tr>
<td>No ATP expended/ kinetic energy [1]</td>
<td>ATP expended/ chemical energy [1]</td>
</tr>
</tbody>
</table>

3.3 Bone consists of active living tissue. The natural process of bone renewal consists of bone formation and bone resorption. Discuss what happens to bone when resorption happens faster than formation. Also discuss how this can be prevented. (You should consult the study guide, textbook and external resources to assist you in answering this question). (8)

Osteoporosis will develop [1]. Bones begin to lose some of their essential elements. The most important of these elements is calcium [1]. Over time, bone mass decreases [1]. As a result, bones lose their strength, become fragile, and break easily [1].

To prevent osteoporosis:

Get calcium in foods. Foods rich in calcium include milk, cheese, yogurt, and other dairy products; green leafy vegetables; tofu; shellfish; Brazil nuts; sardines; and almonds. If diet is insufficient take calcium supplements. A person can be certain of getting enough calcium by taking supplements in the form of pills [1].

Get enough vitamin D. Vitamin D helps the body absorb calcium. The easiest way to get vitamin D is from sunshine. A fifteen-minute walk each day usually provides all the vitamin D one needs. Foods rich in vitamin D include liver, fish oil, and milk fortified with vitamin D [1].
Avoid or limit smoking and the use of alcohol. Both smoking and alcohol use seem to increase the rate of bone loss. By limiting both activities, the risk of osteoporosis may be reduced.

Exercise. Regular exercise builds strong bones. The forms of exercise likely to be most effective include aerobics, dancing, jogging, stair climbing, tennis, walking, and lifting weights. Experts recommend twenty to thirty minutes of exercise three to four times a week [1].

3.4 Differentiate between the different types of muscle tissue and highlight the location where these different muscles tissue types can be found in the body and also give one function of each. Give your answer in table format.

<table>
<thead>
<tr>
<th>Muscle type</th>
<th>Location</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac [1]</td>
<td>Heart [1]</td>
<td>Responsible for pumping blood through the heart chambers and into the blood vessels (circulates blood) and maintains blood pressure [1]</td>
</tr>
<tr>
<td>Smooth [1]</td>
<td>Walls of hollow internal structures [1] such as blood vessels and in digestive, respiratory, urinary organs</td>
<td>Responsible for the movement that force food through the digestive tract, constricts blood vessels and empty the urinary bladder [1]</td>
</tr>
<tr>
<td>Skeletal [1]</td>
<td>Found in muscles that are usually attached to bones. [1] (Combined with connective tissues and neural tissue in skeletal muscles.)</td>
<td>Responsible for moving the head, trunk and limbs, facial expressions writing, talking, swallowing and breathing. [1]</td>
</tr>
</tbody>
</table>

3.5 The lining of the nasal cavity is normally moist, contains numerous cells and rests on a layer of loose connective tissue. Identify the type of membrane this is and provide the main functions of this membrane type.

Mucous membrane [1]
To protect (against bacterial invasion) [1]
To secrete mucus [1]
To absorb water, salts and other solutes [1]

3.6 Write down the reactions that take place when the disaccharide enzymes on the surface of the small intestinal cells, hydrolyze the disaccharides (maltose, sucrose and lactose) to monosaccharides.

Maltase hydrolyses maltose $\frac{1}{2}$ to two glucose molecules $\frac{1}{2}$
Sucrase converts sucrose $\frac{1}{2}$ into fructose and glucose $\frac{1}{2}$

Lactase splits lactose $\frac{1}{2}$ into galactose and glucose $\frac{1}{2}$

3.7 Explain in your own words why the liver is important in carbohydrate metabolism. (5)

The liver converts excess blood glucose to glycogen for storage [1]. This process is known as glycogenesis [1]. However, when the blood glucose level is low, the liver can also produce glucose from other molecules [1]:

It breaks down glycogen into glucose in a process called glycogenolysis [1]
It also forms glucose from amino acids and lactic acid in a process called glyconeogenesis [1]

Question 4 [20]

The liver is essential for the functioning of the digestive system. The end stage liver disease is liver cirrhosis. Search information on liver cirrhosis and then explain in the form of a concise literature review with a maximum of 500 words what liver
cirrhosis is, what will be the effect of liver cirrhosis on the normal functioning of the liver and what would you recommend in order to prevent liver cirrhosis. Techniques to search for reputable information resources are explained in Tutorial letter 301, section 6 and correct referencing techniques in section 7. Add one of your sources referred to, to the assignment.

You will be assessed as follows:

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>MARK ALLOCATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTENT</td>
<td>12</td>
</tr>
<tr>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>Insight into the functions and the effect of liver cirrhosis on the digestive system</td>
<td>4</td>
</tr>
<tr>
<td>Insight into the prevention of liver cirrhosis</td>
<td>4</td>
</tr>
<tr>
<td>Conclusion</td>
<td>2</td>
</tr>
<tr>
<td>TECHNICALITIES</td>
<td>8</td>
</tr>
<tr>
<td>Spelling and grammar</td>
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<tr>
<td>Word count</td>
<td>2</td>
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<tr>
<td>Scientifically written</td>
<td>2</td>
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<tr>
<td>Article correctly referenced</td>
<td>2</td>
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<tr>
<td>TOTAL</td>
<td>20</td>
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</tbody>
</table>

Total mark: 120

End of Assignment 03